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ALL-UNION CONFERENCE ON THE BIOPHYSICS OF ERYTHROCYTES

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Following is a translation of an article by V. Ye. Kuznetsov in Izvestiya Sibirskogo Otdeleniya AN SSSR (News of the Siberian Affiliate of the Academy of Sciences USSR), No. 11, Novosibirsk, 1959, pages 103-104.7

Biophysics, as a new science arising at the junction point of biology and physics, is assuming a steadily growing importance in recent days. The application of physical research methods in biology has made it possible to undertake the investigation of physico-chemical fundamentals of life phenomena. At present, it is becoming more and more clear that the simplest cells of the organism, namely erythrocytes, act in the organism as transport cells, used for the transportation of numerous metabolites, and not only for the transport of oxygen and carbon dioxide. As a result of this fact, and also in view of the exceptionally great medical importance of blood preservation, erythrocytes are becoming an important object of research. This fact is illustrated by two international symposia devoted to the structure and functions of erythrocytes, held in Berlin in 1955 and 1957, and also by the conference held in Krasnoyarsk in July 1959.

The All-Union Conference on the Biophysics of Erythrocytes was organized by the Physics Institute of the Siberian Affiliate of the Academy of Sciences USSR, and was held in Krasnoyarsk on 3-9 July 1959. The conference was attended by scientists from Moscow, Leningrad, Krasnoyarsk, Sverdlovsk, Novosibirsk, Minsk, Irkutsk, Tomsk, and other cities of the USSR. Presented and discussed at the conference were 56 papers dealing with the structure and functions of erythrocytes under normal and pathological conditions, the effect of radiation upon blood cells, the biochemistry of anuclear erythrocytes, the clinical application of the erythrogram method, and other problems concerned with the biophysics of blood.

D. I. Gol'dberg (Tomsk Medical Institute) described the results of numerous years of research on erythrocytes under normal and pathological conditions, and demonstrated the complexity of the structure of blood cells.

P. A. Shershnev (Irkutsk Medical Institute) described the most important aspects of the biochemistry of anuclear erythrocytes.

The physico-chemical characteristics and the mechanism of hemolysis under the action of ionizing radiation were described in a paper read by P. S. Vasil'yev and M. P. Petrova (Central Institute for Hematology and Blood Transfusion).

A number of papers described the results of a study of red blood by the differential (or erythrogram) method, developed in the biophysics laboratory of the Physics Institute of the Siberian Affiliate of the Academy of Sciences USSR. Over a relatively brief period of time, this method has become widely known and has started to be used in other scientific establishments.

The physico-mathematical and physiological fundamentals of the erythrogram method were described by I. A. Terskov and I. I. Gitel'zon. The application of this method during a study of immune hemolysis was described by V. T. Poetova (Physics Institute of the Siberian Affiliate of the Academy of Sciences USSR). Associates at Moscow University -- Yu. B. Kudryashev, Ye. N. Goncharenko, A. B. Utevskaia, and others -- presented the results obtained in a study of the activity of tissue hemolysins following irradiation, conducted with the aid of the erythrogram method. A lively discussion followed the report presented by A. I. Vorob'yev (Central Institute of Postgraduate Medical Training) on the clinical application of this method. It was recommended at the conference that the erythrogram method be called to the attention of clinicians and researchers working on the physiology of blood.

Problems concerned with radiation injury of blood cells formed the subject of papers read by B. N. Tarusov, Yu. A. Kriger, and I. M. Parkhomenko (Moscow University), Ye. D. Gol'dberg (Tomsk Medical Institute) and V. P. Makarov (Physics Institute of the Siberian Affiliate of the Academy of Sciences USSR).

The papers presented by I. A. Serebrennikova, T. S. Fedorova and L. P. Gorbenko (Tomsk Medical Institute) and by T. V. Avramova (Tomsk Scientific Research Institute of Vaccines and Sera) gave data on changes in the fermentative activity of erythrocytes in cancer patients. These papers aroused great interest and resulted in a lively discussion on rational ways of detecting tumor growth.

G. A. Dvorkin (Biophysics Institute of the Academy of Sciences USSR) and Yu. Ye. Moskalenko (Institute of Evolutionary Physiology of the Academy of Sciences USSR) described studies of the structure of erythrocytes based on a determination of their physico-chemical properties. By using various physical methods, these authors arrived at a generally similar concept of the dielectric structure of the erythrocyte membrane.

A large number of studies dealing with the spectrophotometry of hemoglobin and its derivatives were presented at the conference. While studying the oxidation kinetics of hemoglobin and its conversion into hematin, B. G. Kovrov and M. S. Levinson (Physics Institute of the Siberian Affiliate of the Academy of Sciences USSR) obtained data pointing to a nonuniform composition of hemoglobin and to possible age changes of the pigment molecules.

The paper read by N. A. Tokov and M. V. Anisimov (Krasnoyarsk Agricultural Institute) was devoted to a study of the effect exerted by radioactive calcium on the morphological composition of blood.

P. G. Podzol'kov and S. Ye. Moshkina (Krasnoyarsk Medical Institute) presented data obtained during an experimental study of erythrograms and morphological factors of the bone marrow during protein deficiency, and showed changes in the physico-chemical properties of erythrocytes.

A. A. Gurevich and N. A. Golosova (Physics Institute of the Siberian Affiliate of the Academy of Sciences USSR), based on an example involving the reduction of methemoglobin with ascorbic acid, characterized the reduction reaction of hemoglobin, which is very important for the normal activity of erythrocytes.

A number of studies described problems concerned with metabolism in erythrocytes, the evolution of the respiratory function of blood, the effect of biophysical properties of erythrocytes on the electric characteristics of whole blood, infrared spectra of normal and irradiated blood, etc.

The resolution drawn up at the conference emphasized the good results obtained in combined blood research work performed by biophysicists, biochemists, physiologists and clinicians. The resolution suggests that practicing physicians and research workers specializing in human and animal physiology make an extensive use of new blood research methods such as the erythrogram method, the luminescent method involving a count of reticulocytes, the electrophoresis method for studying erythrocytes, the photographic recording of the dynamics of the erythrocyte sedimentation reaction, and the new modification of the copper sulfate method for the determination of hemoglobin.

The conference listed the following most important problems which should be the subject of further research: a study of the structure and the physical chemistry of erythrocytes; a study of metabolism in anuclear cells under normal and pathological conditions; a study of the various hemoglobin types and fractions, and the development of methods for preparing and analyzing such types and fractions; a determination of the qualitative composition of red blood particles and the establishment of factors causing changes in this composition, as well as a clarification of the mechanism of erythrocyte destruction; the development of a quantitative study of erythrocyte injury under the action of ionizing radiation; etc.

In view of the great importance of the problem of blood diseases, and particularly the problem of leukoses, the conference noted that the opening of a specialized hematological infirmary is urgently needed. (At the present time, not a single infirmary of this type is available in Siberia.) In such an infirmary, patients now located in various clinics could receive expert assistance. Basic facilities are available in Krasnoyarsk for an effective examination of hematological patients, based on the use of the most modern methods of analysis.

In order to coordinate studies in the field of biophysics, the conference considered that it would be advisable to set up a permanently operating commission within the system of the Academy of Sciences USSR.

Participants at the conference approved the initiative displayed by the biophysics laboratory of the Physics Institute of the Siberian Affiliate of the Academy of Sciences USSR in convening the present conference, and resolved to hold such conferences once every 2-3 years.

The All-Union Conference on the Biophysics of Erythrocytes in Krasnoyarsk was the first conference devoted to this problem held in our country, and the first conference of biophysicists in Siberia. The holding of this conference demonstrates once more that the Party and government decisions on the development of science in the Eastern USSR, through the efforts of scientists working in the Siberian Affiliate of the Academy of Sciences USSR and in other scientific establishments, are being carried out.

5421

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